INTERACTIVE SOFTWARE: MeshTools

ISE-MeshTools Tutorials

Tutorial 05 : working with tags part 1

tagging “small” objects

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Tutorial 05 includes:

- One .vtk surface file representing a right inner ear of *Mus musculus*
- One .pos file
- One .ntw file
- One .tag file
- One .ori file
- The present .pdf document

Working with tags part 1: tagging small objects

Contents

1. "Small" specimens

By "small" specimens, I refer here to surface files containing a small number of triangles (e.g. <100 000 triangles).

2. About the specimen

The surface file enclosed in this tutorial represents the three-dimensional reconstruction of the right inner ear of a house mouse (*Mus musculus*) obtained by computerized microtomography at the MRI µCT platform housed at the ISE-M.

3. Tutorial

Before using this tutorial, I strongly recommend to download and read ISE-MeshTools User Manual, especially the "Tag" section.

3.1 Download and unzip files

Download and unzip the files associated to this tutorial in a folder containing no accent. Open ISE-MeshTools. Also, make sure that the path leading to the folder containing the tutorial files does not contain any accent. Otherwise, ISE-MeshTools will not be able to open the contained files.

3.2 A brief overview of enclosed files

3.2.1 Prerequisite : activate Tag mode, and display tags.

Press "  " to activate the "draw tag mode". The tag mode is useful when tagging surfaces (as you can only interact with selected objects).

Pressing "  " automatically activates the "display tag mode" (which can be activated/deactivated independently from the "draw tag mode" by pressing "  "). When active, a colour scale bar shows up inside the 3D screen.

Now, unselected meshes are drawn "grey", while selected meshes can be drawn according to tag values at each vertex.

3.2.2 Mouse right inner ear surface and position files

You may load the enclosed .vtk file (File -> Open Surface, then select "Mouse_right_ear.vtk"). When loaded this way, the corresponding opened surface object is selected, which means that it is drawn according to the tag values when the "display tag mode" ("  ") is active. As mentionned in other tutorials, you may interact with selected objects in different ways (see ISE-MeshTools manual for further explanations). As a general rule, when opening a new object, I strongly recommend to change its position in order that it matches the 6 predefined camera positions :

When pressing "  ", object should be viewed from right side.

When pressing “  ” object should be viewed from left side.

When pressing “  ”, object should be viewed from front side.

When pressing “  ”, object should be viewed from back side.

When pressing “  ”, object should be viewed from above.

When pressing “  ”, object should be viewed from below.

Once correctly positioned, you may save the object’s current position (File->Position->Save Position).

The present tutorial contains a .pos file, which you may load in order to place correctly the right inner ear (File -> Open Position, then chose “Mouse_right_ear.pos“).

You can unselect all opened objects by pressing “CTRL +D”, or select all objects by pressing “CTRL +A”. You can delete all selected objects by pressing “Del”.

3.2.3 Mouse right inner ear project file

The present tutorial contains a project .ntw file, which may be useful to directly open the inner ear in a convenient position directly. First, delete all currently opened objects (press “CTRL+A”, then press “Del”). Then open the enclosed .ntw file (File->Open Project, then select “Mouse_right_ear.ntw”). Once loaded, the mouse inner ear surface file object is opened, is given the position enclosed in the “Mouse_right_ear.pos” file. Note that the newly opened surface is unselected, the consequence of which is that when the display tag mode (“  ”) is active, the surface is drawn grey. If you want to display tags, right click on the inner ear to select it.

3.2.4 Mouse right inner ear .ori file

The present tutorial contains a .ori file, which contains orientation labels for the coordinate system orientation helper. You can load this file the enclosed .ori file (File->Orientation labels, then select “Mouse_right_ear.ori”). Once loaded, the system coordinate orientation helper will show the following labels :

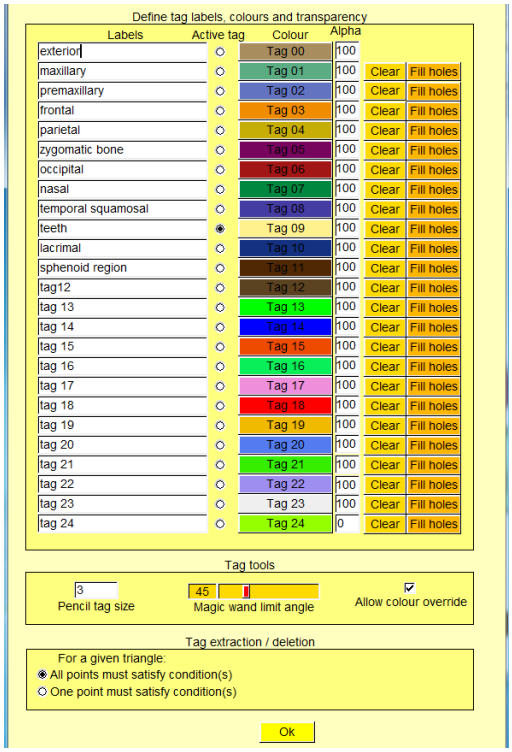
+z axis : superior
-z axis : inferior
+y axis : medial
-y axis : lateral
+x axis : proximal
-x axis : distal

You may set your own orientation axis labels with the “Edit orientation labels” window (Viewing opt.-> Orientation labels)

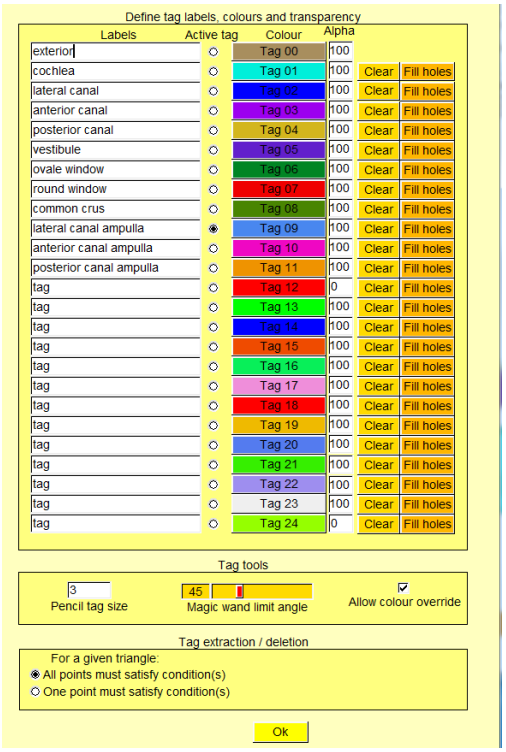
3.2.5 Mouse right inner ear .tag file

The present tutorial contains a .tag file, which contains colours, labels, and transparencies for the 25 editable available tags in ISE-MeshTools. Once loaded (File->Tags and Flags -> Load tag colours and labels, then select “Mouse_right_ear.TAG”), you may notice that the colours of the inner ear have changed.

Also, the information contained in the “Tag options” window have been updated (open this window by pressing “ ”).



Tags window before loading the .TAG file



Tags window after loading “Mouse_right_ear. TAG” file

Available controls :

Define tag labels, colours and transparency group:

Labels : you may define tag labels for all 25 available tags.

Active tag : you may define the currently active tag.

Colour : you may define the colour for all 25 available tags.

Alpha : you may define the transparency for all 25 available tags.

Clear : clears the tag region (all vertices of this region will be set to 0 = Tag 00).

Fill holes : opens the fille hole window.

You may define your own tag labels, colours and transparencies in this window.

3.3 Tagging “small” surfaces with ISE-MeshTools

3.3.1 Recommendations

While tagging, I recommend you to let the “Tag options” window open. You will often need to access the following options :

- active tag (to chose which tag colour is currently active)
- pencil tag size.
- allow colour override option.

3.3.2 Digitization strategy

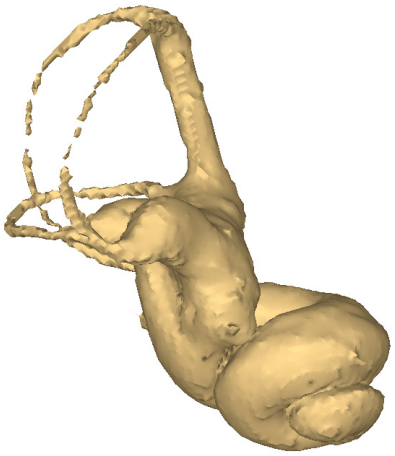
To tag this inner ear, you may use the following 5 steps strategy :

1) Clear the current tags

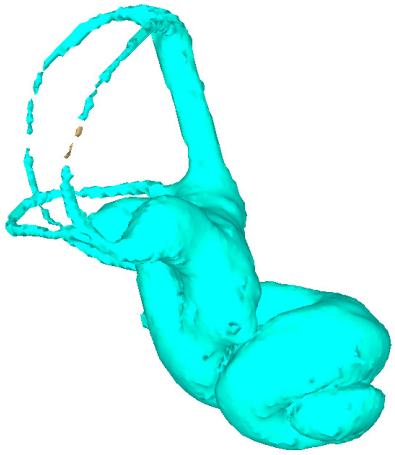
In the “Tag options” window, press “clear” from Tag 01 until Tag 11.

2) Tag the whole inner ear

Select for instance Tag 01 (cochlea). Press  to activate the flood fill. “Allow colour override” option should be checked. Press “T” + left click to tag the inner ear in blue.



Cleared inner ear



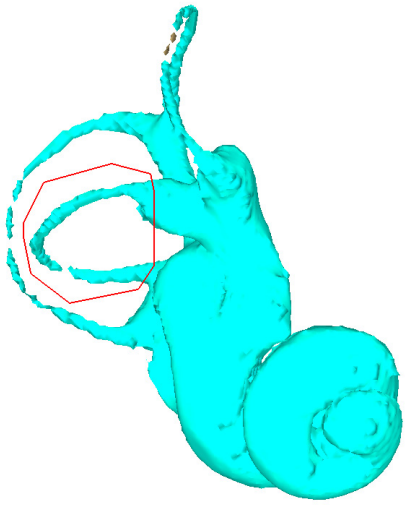
Inner ear tagged using the flood fill tool.

3) Tag the semi-circular canals and the common crus with the lasso tag tool

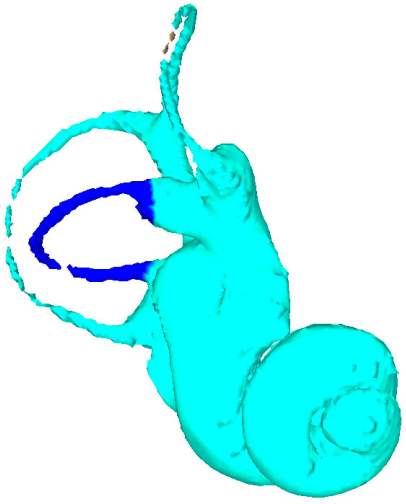
As mentionned in the user’s guide, additional controls become available when using the “lasso tag” (click on  to activate lasso mode):

Left click	Adds a segment to polygon (segments are drawn yellow)

Right click	Connects last segment to first segment. If two segments cross each other, lasso action is canceled. Otherwise, the closed polygon is drawn red.
Middle click or "C" + right click.	Once the lasso il closed (lasso polygon drawn red after a right click), all the vertices falling within the clicked region (outside or inside the polygon) are given a colour corresponding to that of the active tag
T + left click	If the lasso il closed (lasso polygon drawn red after a right click) the vertices are painted using the active tag tool (pencil, magic wand orthe flood fill). Tag propagation is restricted within the area defined by the red polygon.



A red polygon surrounds the lateral canal



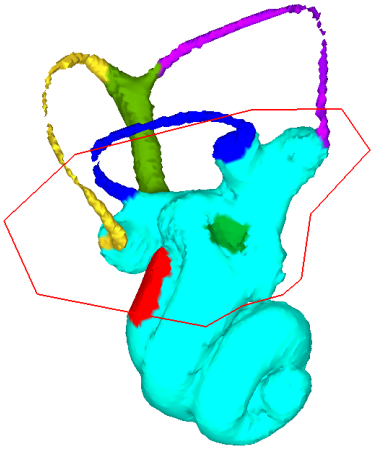
A middle click inside the red polygon colours the lateral canal in blue (tag 02= lateral canal)

3) Paint the ovale and the round windows with the pencil tag tool

- Select the pencil tag tool (press "  ").
- Depending on your needs, change the "pencil tag size" and the "allow colour override" options in the "Tag options" window.

4) Paint the vestibule (lasso tag + flood fill + deactivate "allow colour override")

- Press  to activate the flood fill tag tool.
- Deactivate "allow colour override" in the "Tag options" window.
- Press on  and draw a polygon enclosing the desired region and press T + left click.



A red polygon surrounds the vestibule

"T "+ left click inside the red polygon and on the vestibule colours the vestibule in violet (tag 05= vestibule)

5) Paint the ampullae with the pencil tag tool

- Select the pencil tag tool (press "  ").
- Depending on your needs, change the "pencil tag size" and the "allow colour override" options in the "Tag options" window.

3.4 Saving tags

Remember to regularly save your .vtk file, as there is no "CTRL +Z" option in MeshTools yet.

4. Acknowledgements

Thanks to the MRI imaging platform for the access to imaging facilities.